

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E1

Evaluate the potential for adding additional generation using existing infrastructure, modifying facilities to increase storage and associated generation, and changing operation to provide spinning reserve (e.g., motoring) (Issues addressed: EE 1, 2, and 14).

Resource Goals:

- Maximize the benefits from electrical power generation and ancillary services within other operational constraints.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Add additional equipment if economically justified to enhance spinning reserve.
- Explore the potential to form partnerships with private enterprise to maximize power generation.

Scope:

Within FERC Project 2100 Boundary

Existing Information:

1. Existing facility data – The existing information, such as as-built drawings, operation manuals, maintenance records, etc. about the current water and electrical facility at the Oroville-Thermalito complex.
2. Existing Operation data – The records of historical water and power operations at the Oroville-Thermalito complex, including the reservoir storage, flow at each Powerplant, and the actual power produced.
3. State of California studies currently underway for additional generating capacity within Oroville FERC project boundary.

4. 1997 Hyatt Powerplant Modernization study.
5. 1987 Hyatt Powerplant Flood Operations study.
6. 1985 Thermalito Diversion Dam Powerplant study.
7. Studies performed in the early 1980's for additional generation capacity at various SWP facilities.

Information Needed:

1. The existing data and modeling information needs to be compiled and analyzed to identify potential ways to increase electrical generation benefits.
2. Detailed estimates of electrical power and ancillary service production under the different combinations of infrastructure, physical enhancements, and operations policy that could improve electrical generation benefits.
3. Electrical power market information on demands and prices required for economic evaluation of electrical generation alternatives.
4. Obtain and evaluate information on new ways to generate power through kinetic energy (non-dam, canals).

Level of Analysis:

- Electric power generation benefits are affected by various factors including the time of day the power is generated, environmental constraints, and hydrology, etc. To account for the time of day variance in the values of electric power generation, the electric power analysis on an hourly basis would be needed. This would require detailed computer model simulations of the various alternatives under consideration.
- Reconnaissance level study of alternatives for generation capacity increases (including private sector partnerships, trades, and new generating facilities).

Issues Addressed:

EE1. Consider adding additional generating capabilities (some existing infrastructure).

EE2. Intake on North side of dam - Afterbay outlet motoring to provide spinning reserve.

EE14. Potential physical changes to facility to increase storage and generation. Impacts to existing and potential facilities.

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Issue Statement E2

Evaluate the potential to improve operations through use of real-time watershed hydrologic projections for flood and non-flood conditions.

Resource Goals:

- Improve accuracy of inflow projections
- Improve efficiency of reservoir operations to increase water retained in reservoir storage
- Enhance flood protection
- Improve coordination with data gathering entities.
- Update operational procedures
- Update Feather River computer model if necessary.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Increase recreation opportunities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Maintain maximum possible water levels to enhance recreation opportunities between Memorial Day and Labor Day.

Scope:

Feather River watershed above Oroville Dam.

Existing Information:

1. Short-term weather forecasts – These are provided daily by DWR and NWS meteorologists and span a period of 10 days. The weather forecasts are typically considered accurate for the first 3 days of the forecasts with more uncertainty for the remaining period.

2. Real time weather and runoff data – The real time data is gathered from a wide variety of sources including other public agencies, reservoir operators, and volunteers in several communities.
3. California Data Exchange Center (CDEC) – CDEC is an on-line database operated by DWR. Information on CDEC includes precipitation and temperature data, stream flow data, reservoir operations, snow pack measurements, runoff forecasts, and water supply forecasts. Cooperation of the many public agencies and private entities that contribute to CDEC results in a central location where real time watershed hydrology data is readily available.
4. DWR's Feather River Computer Model – The Hydrology Branch currently operates a Feather River Runoff computer model that takes into account forecasted precipitation and temperatures, measured snow pack, and estimated soil moisture conditions. All of these factors influence the inflow to Oroville Reservoir. This model is run at least once a week and provides a 10-day outlook of forecasted inflows to Oroville Reservoir in six-hour increments. When conditions warrant, the Feather River Runoff model is run as frequently as needed.
5. Nations Weather Services (NWS) Sacramento River Model – This computer model is run jointly with the NWS-RFC forecasters on a daily basis and provides a 5-day outlook at the runoff in the basins of all of the major California rivers, including the Feather River. The model results are provided in six-hour increments. This model operates on similar physical parameters as the Feather River Runoff model and uses in excess of fifteen automated stations in the Feather River basin that collect temperature and precipitation data.
6. PRMS model – The Hydrology Branch continues to upgrade its abilities to provide accurate short-term forecasts for the Feather River basin through improvements to its current models and is also developing a new physical based model called PRMS.
7. Sacramento and San Joaquin Comprehensive Study.

Information Needed:

1. Additional real-time watershed data
2. Evaluation of existing network of data sensors
3. Comparison of predicted inflow with actual inflow.
4. Upstream reservoir operations

Level of Analysis:

Desktop study would rely heavily on historical hydrologic data and evaluate existing information. (Actual versus projected). (Intermediate step would include a white paper by DWR).

Issues Addressed:

EE3. Use real-time hydraulic projections, inflow/outflow rather than yearly projections.

EE12. Utilize current watershed hydrologic data from planning (coordinate with COE data gathering).

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Issue Statement E3

Evaluate potential for improved coordinated operation of Oroville Facilities through additional coordination with other water storage facilities and regulatory and resource agencies (e.g. CALFED).

Resource Goals:

Coordinate the operation of the Oroville Facilities with the following organizations

United States Bureau of Reclamation
United States Army Corps of Engineers
Pacific Gas and Electric Company
Yuba County Water Agency
United States National Marine Fisheries Service
United States Fish and Wildlife Service
California Department of Fish and Game
State Water Contractors
DWR

- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

Existing Information:

1. Current Coordination Activities
2. Flood Control

DWR's Flood Operations Center coordinates the releases from the major reservoirs throughout the state of California to minimize flooding. This coordination involves the operations of the Oroville complex by DWR, Bullards

Bar by YCWA, and the Shasta and Folsom complexes by the USBR. This coordination often involves consultation with the USACE.

3. Hatchery Operations

DWR coordinates with DFG to meet the varying needs of the Feather River Fish Hatchery.

Information Needed:

Level of Analysis:

Needs to be considered as a resource goal for other activities of the Work Group for all other issue statements. Consider historic coordination activities to evaluate effectiveness and opportunities for enhanced coordination.

Issues Addressed:

EE5. Coordination with releases from other water storage facilities? - for fisheries protection CVP facilities preventing straying of salmon and steelhead.

EE6. Coordination and evaluation of DF & G, USFWS and other regulatory agencies release requirements to better fit with reality. High agency level decision.

**Oroville Facilities Relicensing
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Issue Statement E4

Evaluate environmental and economic aspects of different flow regimes of Oroville Facilities operations. Factors to be considered include timing, magnitude and duration of flows, pump-back scheduling and maintenance scheduling, and hatchery operations.

Resource Goals:

- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Protect and increase water supply and power generation capability

Scope:

Varies dependent on parameters investigated. Focus is primarily the Oroville Facilities complex and the Feather River downstream to confluence with the Yuba River.

Existing Information:

1. Hydrologic data (get from USFWS, Michael Morse)
2. Operational data
 - Weather Data (Oroville Dam and Thermalito Afterbay weather stations)
 - Inflow into Lake Oroville (SCADA: midnight report)
 - Storage (Lake Oroville; Diversion Pool; Thermalito Forebay & Afterbay; midnight report; SCADA)
 - FRA: temp graph, average (CDEC)
 - Thermalito Water District water use (Water Treatment Plant; Pitot msmnt; SAP; Concow Creek)
 - Cal Water; water use (Power Canal & Cherokee Rd; Pitot msmnt; SAP)
 - UC Davis IPM Project (Lake Oroville weather)
 - Hyatt Tailrace: elevation & temp (SCADA; staff & tailrace gaging station)
 - Seepage weir (SCADA; Campbell unit; meter in gaging station)

- Palermo Outlet; flow (SCADA; Campbell unit; left abutment staff & gaging station; current meter msmnt; SAP)
- Thermalito Diversion Pool @ TDD; el. (Staff and gaging station)
- Power Canal; el (Staff and gaging station)
- Feather River @ Oroville; el (SCADA; Campbell unit; staff & gaging station above fish barrier; current meter msmnt)
- Fish Hatchery; flow and temp (SCADA; Campbell unit; meter & digital readout at site; Pitot msmnt)
- Thermalito Forebay @ TPP; Forebay and tailrace el (SCADA; Campbell unit; meter in plant; staff & meter on dam)
- Thermalito Afterbay @ western canal; el (Staff and gaging station)
- Western Canal; flow, gate changes, temp, Afterbay el (SCADA; Campbell unit; staff in canal & gaging station; current meter msmnt; manometers; SAP)
- Richvale Canal; flow, gate change (SCADA; Campbell unit; staff in canal & gaging station; current meter msmnt; manometers; SAP)
- Lateral Canal; flow, temp, gate changes (SCADA; Campbell unit; staff in weir & gaging station; current meter msmnt; SAP)
- Sutter Butte; flow, gate changes, temp (SCADA; Campbell unit; staff in weir & gaging station; current meter msmnt; SAP)
- River Outlet; flow, gate changes, temp, backwater el (SCADA; Campbell unit; staff in canal & gaging station; current meter msmnt)
- Thermalito Afterbay @ river outlet, el (Staff and gaging station)
- Oswald Water District; water use (PG&E meter; current meter msmnt; SAP)
- Tudor Mutual Water Co.; water use (Flow & hour meters; electric meter; Pitot msmnt; SAP)
- Garden Hwy Mutual Water Co.; water use (Flow & hour meters; electric meter; Pitot msmnt; SAP)
- Plumas Mutual; water use (Flow & hour meters; electric meter; SAP)
- Middle Fork Feather River; flow (Staff and gaging station; current meter msmnt)
- Hyatt sewer pond report to CRWQCB; flow, weeds, odors (Lift pumps hour meters; pond levels)
- State Water Project standard monthly water quality testing (Lake Oroville; Thermalito Afterbay @ river outlet; Power Canal – quarterly)
- Miscellaneous Water Quality (Hyatt sump; swim areas; local dam areas; turb. Testing @ Hyatt tailrace & Power Canal; Del Oro water project)
- Lake Profile; temp (SCADA; temp probe @ intake)
- Survey Notes (Staff locations; elevations)

Information Needed:

1. (Incorporate USFWS list, Steve Ford)
2. Tributary flows into Feather River downstream of project facilities
3. Reservoir levels
4. Power generation

5. River channel flow, stage, and temperature
6. Reports from Rec/Socioecon on economic data collected (may include econ models developed for that Work Group to assist in understanding economic aspects of various flow regimes)
7. Information from other Work Groups to assist in evaluation of economic/environmental aspects of flow
8. Analyze relationship of different flow regimes with the success of fish releases (timing)
9. What is the contribution to the State economy of the fish produced at the hatchery?
10. What is the relationship of the operations and flow regimes on the incidence of straying by Feather River fish to other rivers?
11. What are economic impacts to downstream communities of different flow regimes (levee stability, repair, groundwater effects, etc.)? (Information from downstream districts, etc.)

Level of Analysis:

Develop models that adequately evaluate different flow regimes (coordinated with environmental and economic evaluations from other Work Groups):

Existing models:

DWRSIM, CALSIM, PROSIM operations models
USBR and UCD temperature models
DWR's Feather River Runoff model
NWS Sacramento River model
DWR PRMS model

Run simulations as necessary.

Dictated to a certain extent by requests from other Work Groups

Issues Addressed:

EE4. PLC upgrades?

EE7. Potential to use support system models to evaluate different flow regimes with historic and real-time information

EE8. Why is there no requirement to maintain minimum emergency storage at Lake Oroville? (Evaluate needs related to other resources)

EE13. Operational constraints as they relate to other resources

EE25. Operations and engineering of the project determine the manner and extent water is moved into, through and out of the project area. Current operations, which affect timing, magnitude and duration of flow from current release schedules, pumpback scheduling and maintenance schedules, impact both lotic and lentic ecosystems

affected by the project. Operations need to be examined and their impacts evaluated and minimized for inclusion into terms and conditions of the settlement.

EE26. Facility operations and impact – on bass fishery and spawning activities at afterbay. (Protect and enhance bass fishery)

EE28. How do the pump-back operations during the summer months affect water temperatures required for holding and rearing of steelhead and spring-run Chinook salmon in the low-flow section and in the river downstream of Thermalito Afterbay?

EE32. Adequacy of current instream flow requirements to conserve anadromous salmonids, their habitats and forage. This includes providing a range or schedule of flows necessary to optimize habitat, stable flows during spawning and incubation of ingravel forms, flows necessary to ensure redd placement in viable areas, and flows necessary for channel forming processes, riparian habitat protection and maintenance of forage communities. This also includes impacts of flood control or other project structures or operations that act to displace individuals or their forage or destabilizes, scours, or degrades habitat.

EE33. Impact of hatchery facilities and/or operations on anadromous salmonids. This includes the direct, indirect and cumulative impacts of hatchery product on anadromous salmonids and the direct, indirect and cumulative impacts of hatchery facilities and operations on salmonids and their habitats.

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Issue Statement E5

Impact of flood releases, including ramping rates, on Lake Oroville dam (including need for access to north side of dam) and downstream facilities including downstream levee stability and potential for ameliorating downstream flooding through coordinated releases with other water storage facilities. Consider past floods, improvements in channel carrying capacities, need for more storage (e.g., installing Obermeyer gates on the emergency spillway ogee), operational changes, early warning system for downstream releases, and updating of flood operation manual.

Resource Goals:

- Update flood operation manual
- Minimize flood related impacts at Oroville Dam
- Minimize flood related impacts along the Feather River downstream of Oroville Dam
- Identify potential improvements to flood control operations including better coordination with other flood control facilities
- Identify potential improvements to flood control facilities both at Oroville Dam and downstream along the Feather River
- Enhance downstream levee stability
- Enhance downstream channel flow capacity
- Enhance access to north side of dam during flood control operation
- Improve water supply storage
- Improve early warning system and coordination and communication with local and State agencies
- Produce flood inundation maps for various flows
- Establish “boundary of no significant impact”
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
 - Improved coordinated operation of Oroville Facilities through additional coordination with other water storage facilities and regulatory and resource agencies (e.g. CALFED).
 - Increase the priority for flood control

Scope:

The Feather River basin from Oroville Dam to the point of no significant impact within the context of the Comprehensive Study.

- The Feather River basin from Oroville Dam to confluence with the Yuba River, (If this is the area then what are the other facilities to be considered for coordinated releases?)

Existing Information:

1. The Flood Operations Manual is available for review at *resource library*.
2. Comprehensive Study (COE/DWR)
3. DWR review of Feather River basin hydrology
4. Historical data during flood conditions

Information Needed:

1. Anticipated flood control releases
2. Downstream Feather River flows
3. Downstream Feather River Stage
4. Downstream Feather River rates of change in flow and stage
5. Downstream Feather River channel capacity (potential removal of downstream islands or other obstructions to improve downstream conveyance to design criteria)
6. Currently the Yuba County Water Agency is proposing a comprehensive study to improve flood control on the Feather/Yuba system. This work will continue over the next several years.
7. Sutter County feasibility study for improved flood protection

Level of Analysis:

Options to be investigated include:

- Coordinated releases with other water storage facilities (Which other facilities, there are a number of upstream reservoirs with Lake Almanor being the largest (for Oroville Dam to Yuba confluence), reservoirs in the Yuba basin (for Yuba confluence to Sacramento confluence), and reservoirs on the Sacramento basin (for Sacramento River through Sacramento area)
- Improvements in channel carrying capacities of Feather River
- Additional flood control storage (e.g., installing Obermeyer gates on the emergency spillway ogee)
- Operational changes

Early warning system for downstream releases

This will depend on the final scope. Could vary from relatively simple flood routing through the Oroville – Thermalito Complex to full scale flood routing of the Upper Feather River, the Oroville – Thermalito Complex, the Lower Feather River, the Yuba River, the Sacramento River the American River and the Sacramento River flood bypass system.

No study needed at this time. Comprehensive Study and the Yuba/Feather Study will be reviewed by the Work Group to evaluate what if anything might be needed in future.

Issues Addressed:

EE11. Coordinate releases with other water storage facilities for flood release

EE17. Update flood operation manual

EE19. Early warning system for downstream releases

EE21. Outflow impacts to downstream flood risk (levee stability) COE?

EE22. Stability of Oroville levee system through low flow section and effects of high flow

EE23. Evaluate channel capacities and potential need for more storage / flood protection engineering and operations deflection into levees by gravel bars

EE47. In the FERC Part 12 guidelines, the Probable Maximum Flood (PMF) is to be examined after each major flood event. The Feather River has had two major flood events since 1971; once in February 1986 and again in January 1997. The FERC Part 12 regulation guidelines also state that when new Hydro-meteorological Reports (HMR's) are issued, the PMF is to be re-examined. New HMR's (HMR 58 & 59) were issued in 1999, thus precipitating the Oroville 2100 project to be re-examined in light of the new data. I think that this has been done for the 2100 project in the last Part 12 inspection and the Work Group should be given the correct data. If not done, the question is why not?

EE51. Provide the Work Group with the study data done on installing Obermeyer Gates on the emergency spillway ogee to raise the reservoir elevation in a major flood runoff event? What is the probability of this installation?

EE52. Provide the workgroup with the latest PMF, HMR, and PMP (probable maximum precipitation) data?

EE53. When was the last "Inflow Design Flood" (IDF) study done and was it done on current data?

EE56. Prepare flood inundation maps for a 1997(?) worse case with 300,000 cfs coming out of the dam's normal and emergency spillways. In 1997, it is believed that Oroville storage was almost to a point where the 300,000 cfs of inflow was going to pass through the reservoir. DWR was making plans to evacuate the power plant. The 300,000 would have topped the levees and put 10 feet of water into the town of Oroville.

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Issue Statement E6

Effect of ramping rates on downstream facilities, power generation, water supply, water temperatures, and fish.

*(Talk to FERC – ask about scope for Relicensing vs water supply issues since water supply is part of project operations. Need clarification)

Resource Goals:

- Minimize water supply impacts associated with ramping.
- Minimize the effects of ramping rates on fish and other aquatics regarding catastrophic drift and stranding.
- Maintain operational flexibility for power generating purposes
- Balance competing needs and impacts of required water supply provisions with hydro generation and ramping rates
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

Oroville Dam to the confluence of the Yuba River. Limits to flow of up to 17,000 cfs.

Existing Information:

Operating restrictions on ramping rates on river releases as referenced in the Oroville Facilities Relicensing Initial Information Package.

Information Needed:

1. Quantify the relationship between ramping rates from the Oroville Facilities, water temperatures and downstream facilities such as levees, marinas, diversions, and recreation areas.
2. 15-minute ramping data
3. Quantify the effect of ramping rates on power generation.

4. Quantify (or at least qualify) the effects of ramping rates on fish of interest including rearing and spawning habitats, migration, and angling availability.
5. “Ramping rates” will need to be more clearly defined. (Rate of change of release)
6. Flow data below dam (15 minute increments – check with USFWS)
7. A detailed analysis of the relationship between release rates, river stages, and temperature at various locations in the channel will require computer simulations.
8. Models may also help to evaluate the effects of ramping rates on fish when coupled with adequate information on the habitat and behavior of various life stages of the various species of interest.

Level of Analysis:

Review existing literature and cross sectional data tied to geomorphic data, water level changes in Afterbay as a function of time. Coordinate with Environmental Work Group.

No need for ramping rates for Afterbay or Hyatt releases to reservoir-like water bodies.

Issues Addressed

EE10. Ramping rates effects on downstream facilities.

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Issue Statement E7

Effect of the project including discharge (magnitude, frequency and timing) and ramping rates and the altered stream hydrology on substrate scour, mobilization of sediments, turbidity levels, and riparian vegetation in the low flow reach and downstream of the Afterbay

Resource Goals:

- Enhance and maintain natural geomorphic processes to the extent feasible
- Maintain economic benefits of gravel mining operations
- Maintain ability to operate Oroville Facilities in a safe, efficient and economic manner
- Enhance and maintain riparian habitat and water quality
- Maintain economic benefits of agricultural production downstream to confluence of Honcut Creek
- Maintain channel conveyance capacity
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

Feather River low flow reach from the Fish Barrier Dam downstream to the confluence with the Yuba River.

(can be expanded if initial study indicates the need to change scope)

Existing Information:

1. River flow and stage data
2. River temperature data
3. Flood release records
4. Reservoir turbidity records
5. Ramping criteria
6. Aerial photographs
7. Oroville reservoir sedimentation studies
8. (See G-1)

9. Existing Restoration Plans (Tuolumne, Almanor, etc.) associated with other large hydropower projects
10. USGS Blodgett Survey 1972
11. 'Sediment Transport in Feather River' USGS 1978
12. Establishment of Feather River Channel Characteristics – DWR
13. DWR Feather River Spawning Gravel Baseline Study 1982
14. Floodplain Information for Feather River – Corps and State Reclamation Board 1968
15. Evaluation of Fish Populations and Fisheries, Post Oroville Project Feather River CDFG 1977
16. Fact Finding report on Flood Damage in Feather River Basin – Porgans & Associates
17. Bibliography from Porgans

Information Needed:

1. Sediment transport analysis
2. Riparian vegetation survey analysis (developed through Environmental Work Group)
3. Current aerial photographs
4. Release data (15-minute, 60-minute, average daily)
5. (insert USFWS hydrology needs provided by Morse for Issue Statement E4)
6. Inventory primary channel types
7. Inventory existing riparian comp by stream type Existing snag inventory
8. Characterize primary sources of sediments to the river below the dam
9. Quantify input from four tribs upstream and below the dam Inventory primary depositional features, depth, form, sinuosity, etc.
10. Evaluate materials deposited and primary dep features (sediment size classes)
11. Evaluate sufficiency of aerial photography for these studies
12. Determine sediment deposition rate, composition
13. Determine level of analysis for reservoir sedimentation
14. Establish surveying permanent cross-sections for geomorphic evaluation
15. Total channel width and depth of flow over active channel, functional attributes, Manning's roughness, shear force, stream power, particle sizes, D84 surface particle size
16. Effect on formation of gravel bars at river outlet

Level of Analysis:

This study would rely on historic reservoir operational and flood release data as well as comparing “before “ and “after” aerial photography. The reservoir sedimentation study and historic turbidity records could help predict sediment pass through. Develop report of existing information to Yuba River to determine further needs (data gap analysis). Flood Flow Frequency study for the river (Corps responsibility?) Coordinate with Environmental Work Group on effects of discharge on riparian vegetation. (T7 and others related to riparian vegetation and G issues related to sediment transport)

Issues Addressed:

EE29. Project features and operations alter the hydrology of the system, creating the possibility for scour zones within both natural and designed channels. What affects do discharge and ramping rates have on substrate scour and the mobilization of sediments into the water column downstream? How have turbidity levels been affected by project operation?

EE30. Alterations in stream hydrology affect the natural fluvial geomorphologic processes of a riverine system. How has the change in magnitude, frequency and timing of peak flows on the Feather River affected riparian vegetation recruitment in the low-flow reach and immediately downstream of the Afterbay?

EE36. Direct, indirect and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, bank stability and extent, duration, and repetition of high flow events.

EE41. Direct, indirect and cumulative impacts of project facilities and operations on sediment movement and deposition, river geometry, and channel characteristics. This includes impacts on stream competence, capacity, bank stability and extent, duration, and repetition of high flow events.

EE42. Bedload transport, current condition of habitat potentially impacted by project and alternatives to conserve or enhance

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Issue Statement E8

Effect of reservoir sedimentation and those sediments on project operations

Resource Goals:

- Evaluate affect of reservoir sedimentation and sediments on project operations.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

Oroville Lake area.

Existing Information:

1. 1993 – 1994 Lake Oroville Siltation Study
2. 1999 DWR study of storage loss (also Porgans study)

Information Needed:

1. Determine sediment deposits and rate of sedimentation
2. Potential impacts to project from re-operation of upstream facilities

Level of Analysis:

Literature review. Recent studies (1993-4) indicate this is not currently an issue related to this project. Prepare a white paper indicating resolution of this issue with no further studies necessary at this time. Aerial photography will be done this Fall to further substantiate this conclusion. White paper will include assessment of effects from 1997 flood.

Issues Addressed

EE9. Any plan to address increasing siltation in lake?

EE27. Sediments behind dam (operations)

EE 46. At the first workgroup meeting, a presentation was given on how the water system works from reservoir to Southern California. A chart was shown on Oroville reservoir storage denoting the flood storage limits and elevations at time of year and downstream water requirements for the delta. In the presentation, it was said that the data and chart was from 1971 that DWR in Sacramento was using for those storage elevation levels and acre-feet amounts. I question that information and sincerely hope that is not the case.

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Issue Statement E9

Effect of Oroville Facilities power generation pricing schedule on local economy.

Resource Goals:

Identify impacts of power generation pricing on local economy.

Scope of Work:

Analyze the net power cost of operating the Oroville Facilities.

Existing Information:

Operational data

Information Needed:

Change in Oroville operations due to power generation pricing schedule that could be used to evaluate impacts on local economy

Level of Analysis:

Power generation revenues from the Oroville Facilities are used to offset the net power cost of owning, operating, and maintaining State Water Project power facilities. Several local community groups have expressed an interest in purchasing power at the wholesale level from the Oroville Facilities. Power purchases from the Oroville Facilities would require formation by the local community of a municipal power utility. The municipal power utility would be a legal business entity empowered to negotiate and enter into contracts to purchase power at the wholesale level.

This issue regarding power purchases by a local municipal power utility should be postponed and subsequently addressed during the settlement phase of the relicensing process.

Issues Addressed

EE16. Inequity of power pricing structure

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E10

Effect of future water demands on project operations including power generation, lake levels and downstream flows. Consider sale of existing water allotments to downstream users

Resource Goals:

- Maintain maximum water supply and project operational characteristics
- Maximize water supply and power generation while maintaining system flexibility and reliability.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Maintain maximum possible reservoir water levels to enhance recreation opportunities between Memorial Day and Labor Day.

Scope:

FERC Project 2100 boundary

Existing Information:

1. CALFED long-term modeling
2. CALFED transfers north to south
3. CALFED water requirements (Bay-Delta)
4. CVPIA water delivery requirements (delta)
5. ESA requirements
6. Current water delivery
7. Water Supply Forecasts

Information Needed:

1. Analyses of how current demands are met and future demands.
2. Need to include extremes of water years (wet, dry and average)
3. Information being used to develop Bulletin 160-03 as available

Level of Analysis:

Curtis' group will provide paragraphs using Bulletin 160-98; explain constraints associated with projections in future. EIR process for future project facilities should address changes to operation at Oroville. Studies are ongoing, no further studies are needed and not a Relicensing issue.

Issues Addressed:

EE 18. What are 50-year projections for water/power demands and plans to meet those needs and impacts of meeting demands? (Context of existing full allocations)

EE20. Sale of existing water allotments to downstream users

EE57. Maximize water supply and power generation while maintaining system flexibility and reliability.

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E11

Effect of tires in Parrish Cove and Bidwell Cove and stakes used to hold down recycled Christmas trees on public safety

Resource Goals:

Scope of Work:

Existing Information:

Information Needed:

Level of Analysis: This issue has been taken care of under existing maintenance – no further action necessary. The stakes have been removed, responding to public concerns and safety issues. The tires are currently being dealt with for proper disposal. No further Work Group effort needed. (page describing the status of this issue statement will be prepared by Dave Ferguson)

Issues Addressed:

EE54. Effect of tires in Parrish Cove and Bidwell Cove (mosquito abatement).

EE55. Effects of stakes used to hold down recycled Christmas trees on public safety

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E12

Evaluate operational and engineering alternatives including selective withdrawal from Lake Oroville, Thermalito Afterbay, the hatchery, and the low flow section to meet various downstream temperature requirements

Resource Goals:

- Quantify the relationship between various release schemes and water temperature from reservoir to the confluence with the Yuba River.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Provide adequate water temperatures for fisheries, agriculture and recreation temperature requirements.

Scope:

Oroville Dam to downstream of the Thermalito River outlet (Robinson riffle)

Existing Information:

1. 1969 Water Diversion Agreement between DWR and Joint Water District Board.
2. Water temperature objectives for the Feather River Fish Hatchery are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for April through November objectives.
3. The objectives for the Feather River downriver of the Afterbay Outlet are a narrative. During the fall months, after September 15 the temperatures must be suitable for fall-run chinook. From May through August, they must be suitable for shad, striped bass, and other warm water fish. Water temperatures are met through a shutter controlled intake gate system at the Oroville Dam that allows DWR to select water for release from various reservoir depths.

4. The water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Rice farmers desire water temperatures of 65°F from approximately April through mid-May and 59°F during the remainder of the growing season. DWR is now trying to accommodate these needs by releasing water at the higher end of the temperature range required for the hatchery.
5. Salmonid temperature preference studies and reviews, including U.C. Davis laboratory temperature preference study for steelhead trout.
6. Mean monthly temperature model for the Feather
7. National Marine Fisheries Service temperature criteria for the Feather River at Robinson Riffle - temperature requirements for salmon and steelhead in Feather River low flow channel.
8. NPDES permit for the Feather River Fish Hatchery and monitoring data
9. Temperature data from the low flow channel and below Thermalito Afterbay outlet
10. Hourly temperatures recorded at 20 sites between the Thermalito Diversion Dam and Live Oak by DWR-ESO. Began in 1997 but records are incomplete until 1999.
11. USGS recorded temperatures at gage downstream from Oroville Dam, 1958 to 1992, continuous temperatures since 1995. ???
12. OFD has recorded mean daily water temperatures at the Feather River Hatchery since initiation of hatchery operations and Robinson Riffle since July 31, 2000.
13. USGS has published records of maximum and minimum daily water temperatures at the Thermalito Afterbay Outlet from October 1968 through September of 1992. Since 1992, only mean daily water temperature data is available from OFD.
14. River temperature model developed by UC Davis under contract with DWR-ESO in 2000

Information Needed:

1. Environmental Work Group
2. Detailed analysis will require a computer simulation tool, which the Department plans to develop with the help of consultants.
3. Engineering studies of facilities modifications (Phase 2 would include engineering studies to evaluate possible engineering solutions to meet temperature goals without impacting water supplies, power generation, etc objectives)

Level of Analysis:

Modeling should include level of confidence with distance downstream.

(Could collapse partially into environmental issues and combined E4)

Issues Addressed:

EE 15. Evaluate temperature requirements and potential Eng. (?) operational modifications

EE 43. Adequacy of selective withdrawal structure to maximize water temperature for anadromous salmonids

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E13

Evaluate operational and engineering alternatives to prevent interbreeding of fall and spring-run Chinook salmon in the low flow section of the Feather River (e.g., migration barrier and/or flow and temperature changes)

Resource Goals:

- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

Existing Information:

Information Needed:

General scope and nature of expected mechanisms to accomplish the Environmental Group's goal and objectives. (Need this from Environmental Work Group)

Level of Analysis:

(Activity associated with this Issue Statement needs to be delayed until environmental work group evaluates their concerns relative to prevention of interbreeding.

Environmental group will work with E&O to analyze whatever drives their concerns.

(Study may develop after receiving input from environmental group)

Issues Addressed:

EE 24. What engineering or other reasonable and prudent solutions are available that would prevent the interbreeding of fall and spring-run Chinook salmon in the low flow section of the Feather River (migration barrier and /or flow and temperature changes in the low flow section)?

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E14

Evaluate operational alternatives that balance and maintain acceptable water quality standards including those for MTBE under all operational plans and conditions

Resource Goals:

- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to health, public project facilities, downstream properties, and fish and wildlife habitat.
- Enhance environmental resources such as fish and wildlife habitat and water quality.
- Stop sewage spills into Lake Oroville

Scope:

FERC project boundary

Existing Information:

1. Evaluation of MTBE in SWP, DWR (1997)
2. SWP Biennial Water Quality Report (1999)
3. Ongoing water quality monitoring data (DWR)

Information Needed:

1. Level of existing and anticipated future recreation uses and associated MTBE input from Environmental Work Group. Phased approach once water quality issues are defined or changes from other work groups that may alter water quality that may trigger study.

Level of Analysis:

(Wait until information available from Environmental Work Group)

Issues Addressed:

EE 37. One of the most significant environmental changes caused by the Oroville Facilities Project was changing the nature of this relatively low elevation waterway from a lotic to lentic system. The confluence of three tributaries of the Feather River and its free flowing nature has been replaced by Lake Oroville. The transport functions

(sediment, nutrients etc.) normally associated with the energy of a lotic system have been replaced by an overall storage function of a lentic system. Thus, there are water quality changes accompanying this shift of ecosystems both within and downstream of the lake. The FWS is concerned about the effects of the current project operations on water quality and changes that may occur with new license conditions. We seek assurance that sufficient numbers of water quality constituents are investigated and that appropriate and rigorous protocols are followed. We seek assurance that investigations will lead to determination of operations alternatives that balance and maintain acceptable water quality standards under all operational plans and conditions set forth in the final agreement.

**Oroville Facilities Relicensing
(FERC Project No. 2100)
Engineering and Operations Work Group
Preliminary Issue Sheet**

Issue Statement E15

Evaluate operation alternatives that maintain or improve current water supply under all operation plans and conditions.

Resource Goals:

- Maximize water supply and power generation while maintaining system flexibility and reliability.
- Add additional power generation capacity if economically feasible.
- Maintain or increase the water supply for all project purposes.
- Maintain or increase operational flexibility and availability.
- Maintain or increase generating capacity.
- Maintain or enhance recreation facilities.
- Continue to operate the Oroville facilities in a safe manner and maintain or enhance flood protection including maintaining adequate channel capacity downstream.
- Cause no damage to project facilities, downstream properties, and fish and wildlife habitat.
- Improved coordinated operation of Oroville Facilities through additional coordination with other water storage facilities and regulatory and resource agencies (e.g. CALFED).
- Enhance environmental resources such as fish and wildlife habitat and water quality.

Scope:

FERC Project boundary

Existing Information:

1. CALSIM model
2. Historical Oroville – Thermalito Complex Operation Data

Information Needed:

1. Detailed local project operation model
2. Water Supply Operation targets at the Project Boundary
3. Use information gathered for E2

Level of Analysis:

SWP water supply operations are made to meet both downstream water rights and SWP contractor delivery. The SWP deliveries are made at a point outside the Project Boundary and are outside of the scope of this investigation; however, these operations do set seasonal “boundary” conditions on the operations within the Project Boundary. Run CALSIM model to determine boundary conditions for detailed local project

operations model. These will then be used to carry out alternative simulations with the detailed local project operation model.

Issues Addressed:

EE13. Operational constraints as they relate to other resources and water supply

EE 14. Potential physical changes to facility to increase storage and generation - Impacts to existing and potential facilities.

EE57. Maximize water supply and power generation while maintaining system flexibility and reliability.